

Exploration Medical Capability - Technology Watch

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ABSTRACT

The objectives of the Technology Watch process are to identify emerging, high-impact technologies that augment current ExMC development efforts, and to work with academia, industry, and other government agencies to accelerate the development of medical care and research capabilities for the mitigation of potential health issues that could occur during space exploration missions. The establishment of collaborations with these entities is beneficial to technology development, assessment and/or insertion. Such collaborations also further NASA's goal to provide a safe and healthy environment for human exploration.

The Tech Watch project addresses requirements and capabilities identified by knowledge and technology gaps that are derived from a discrete set of medical conditions that are most likely to occur on exploration missions. These gaps are addressed through technology readiness level assessments, market surveys, collaborations and distributed innovation opportunities. Ultimately, these gaps need to be closed with respect to exploration missions, and may be achieved through technology development projects. Information management is a key aspect to this process where Tech Watch related meetings, research articles, collaborations and partnerships are tracked by the HRP's Exploration Medical Capabilities (ExMC) Element. In 2011, ExMC will be introducing the Tech Watch external website and evidence wiki that will provide access to ExMC technology and knowledge gaps, technology needs and requirements documents.

EXPLORATION MEDICAL CAPABILITY

The Exploration Medical Capability (ExMC) Element, one of six elements within NASA's Human Research Program (HRP), is charged with reducing the risk of the "inability to adequately recognize or treat an ill or injured crewmember" during an exploration mission.

To address this risk, the Element must

- Define requirements for crew health maintenance
- Develop treatment scenarios
- Extrapolate from the scenarios to health management modalities
- Evaluate the feasibility of these modalities
- Develop technology and informatics that will enable the availability of medical care and decision support systems

THE CONDITION LIST

There are approximately eighty conditions on the evidence-based medical condition list, approved by NASA's Space Medicine Division in July 2009.

The conditions were gathered from several sources

- Space flight medical incidents
- Conditions on the Shuttle medical checklist
- Conditions on the International Space Station medical checklist
- Expert opinion

The conditions were prioritized by a panel of flight surgeons, physician astronauts, engineers, and scientists based on incidence, consequence, and mitigation capability.

The condition list is a "living document"

- New conditions can be added to the list
- The priority of conditions on the list can be adjusted as screening, diagnosis, or treatment capabilities change, or if mission assumptions are updated.

LINKS

Human Research Program ExMC Site
<http://humanresearch.jsc.nasa.gov/elements/exmc.asp>

ExMC Tech Watch Wiki Site
TBD

HRP Roadmap
<http://humanresearchroadmap.nasa.gov/>

APPROACH

Individual Technology Gaps are assigned to one of the NASA centers (Ames Research Center, Glenn Research Center, Johnson Space Center, and Langley Research Center) to manage associated technology watch activities. Each gap lead will utilize their expertise, support from other centers and the National Space Biomedical Research Institute as appropriate. Tech Watch efforts to maintain knowledge of the rapidly evolving biomedical technologies include: market surveys; workshops technology readiness level assessments; identification of collaboration and distributed innovation opportunities; and recommendations to the Element on future options.

IDENTIFICATION OF GAPS

From the prioritized condition list, ExMC annually determines the capabilities needed to address the medical conditions of concern. Where such capabilities are not currently available, a gap is identified.

ExMC currently identifies gaps in the following areas:

- Validation of Medical Standards
- Risk Quantification
- Risk Mitigation
- Monitoring and Treatment of Conditions of Concern
- Enabling Capabilities

For each gap, ExMC conducts a Technology Watch to identify emerging high-impact technologies that

- Augment ongoing efforts
- Accelerate the development of medical care and research capabilities

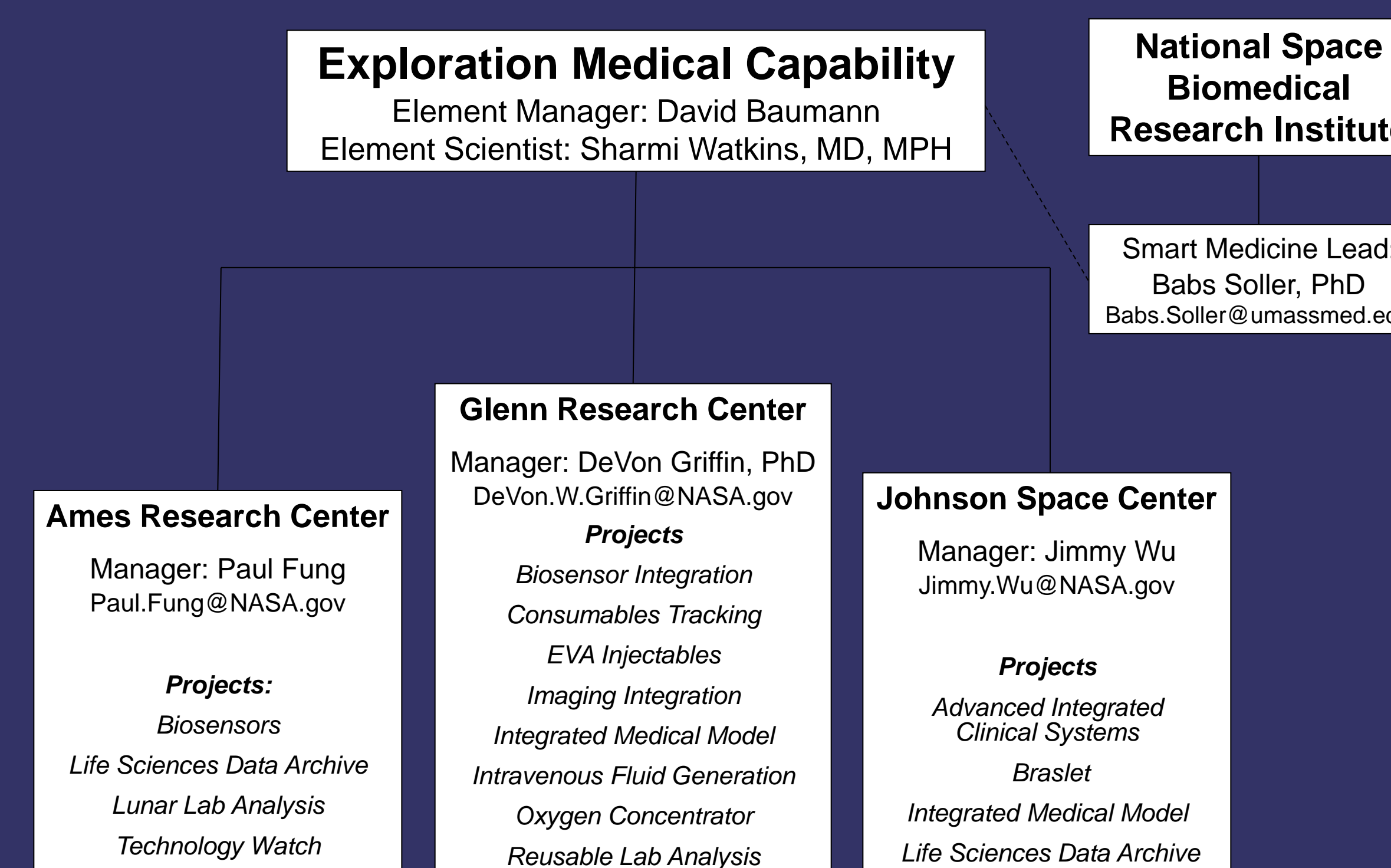
AREAS OF INTEREST

- Novel medical screening technologies
- Delivery of medical training to non-clinicians
- Autonomous medical procedure systems
- Noninvasive diagnostic imaging
- Smart ventilators and oxygen concentrators
- Minimally invasive laboratory capabilities
- Stabilization and treatment of bone fractures
- Wound care and wound closure
- Rapid vascular access
- Advanced dental care
- Intravenous fluid generation
- Inventory tracking for medications and other consumables
- Medication stability and shelf-life preservation
- Biomedical monitoring capabilities
- Medical data management systems
- Prevention and treatment of radiation sickness
- Diagnosis and treatment of renal stones
- Delivery of medications to a suited crewmember
- Eye wash capabilities
- Auscultation in a noisy environment



Artist's Concept of Manned Exploration Mission, NASA

ORGANIZATIONAL STRUCTURE



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